Amendments to the Specification:

Please replace the paragraph beginning at page 1, line 5, with the following amended paragraph:

This application claims priority from U.S. Provisional Patent Application No. 60/267,658, filed on December 19, 2000 and entitled "Polarization ~~insensitive integrated optical processor~~Insensitive Integrated Optical Processor,"~~; No. 60/275,913, filed on March 14, 2001 and entitled "Pure Optical 3R Device"; No. 60/284,798, filed on April 18, 2001 and entitled "Integrated Multichannel Receiver"; No. 60/260,632, filed on January 8, 2001, titled "Multiple Channel Wavelength Converter"; and co-pending U.S. Patent Application No.09/991,136, entitled, "Method and Apparatus for Achieving Wide-Bandwidth Optical Amplification," filed on Nov 16, 2001 and co-pending U.S. Patent Application No. 09/991,272, titled, "Optical Signal Converter with Filtered Output," filed on Nov 16, 2001. The disclosures~~ the disclosure of which ~~are all~~ is hereby incorporated by reference in ~~their~~ its entirety.

Please replace the lengthy paragraph beginning at page 4, line 31, with the following two paragraphs, both of which are amended:

The PPLN may utilize quasi-phasematching or other nonlinear optical phasematching processes in order to achieve three-wave mixing. While DFG is one nonlinear interaction enabled by three-wave mixing, other interactions, such as second harmonic generation (SHG), optical parametric amplification (OPA), optical parametric generation (OPG), and sum frequency generation (SFG) are also forms of wavelength conversion and as such may also be performed by the DFG. The PPLN may be comprised of ferroelectric, semiconductor, polymer, organic or other materials known to perform nonlinear optical frequency mixing. Other ferroelectric materials include congruent lithium niobate, congruent magnesium-doped lithium niobate, congruent lithium tantalate, congruent magnesium-doped lithium tantalate, stoichiometric lithium tantalate, stoichiometric magnesium-doped lithium tantalate, stoichiometric lithium niobate, stoichiometric magnesium-doped lithium niobate, KTP, BBO, and other known optical materials. Quasi-phasematching may be enabled in the PPLN by use of electric-field poling or other techniques for achieving periodic inversion of domains. In this fashion, phasematching between the pump, signal and converted signals may be achieved, and

energy may be exchanged between the three waves, thereby enabling optical frequency conversion, or "wavelength conversion".

The optical circulator 12 has three ports so that optical signals received at port 1 are passed to port 2, optical signals received at port 2 are passed to port 3. The first port 1 of the circulator 12 receives one or more input signals at frequency f_s and one or more energizing pump signals at frequency f_p. The first end of the PPLN waveguide 10, i.e., the DFG, is coupled to the second port 2 of the optical circulator through the PBS 13. The third port 3 is the output port of the polarization-insensitive integrated wavelength converter. Stated generally, the input signals and pump signals from port 1 of the circulator 12 are passed to the PPLN waveguide 10 which mixes the input signals and pump signals to generate converted signals. The PBS 13, the optical by-pass path 14, and the half-wave plate 16 operate on the polarization states of the optical signals for maximum efficiency of the integrated wavelength converter, and the resulting converted signals, input signals and pump signals are passed back through the PBS 13 to port 2 of the optical circulator 12, which passes all the optical signals out through port 3. This is indicated by the "f_p, f_s, f_c" in the drawings.

Please replace the paragraph beginning at page 6, line 32, with the following amended paragraph:

Fig. 1B depicts a multi-channel system similar to that disclosed in Fig. 1A. Three optical circulators 12a, 12b and 12c receive three sets of input signals and pump signals[[,]]<u>.</u> The PBS **[[12]]** <u>13</u> is coupled <u>to</u> the second port 2 of the optical circulators 12a, 12b and 12c **[[1]]** to create a plurality of channels, which is each coupled to a DFG waveguide 10a, 10b and 10c in a single PPLN structure (in this embodiment) 11 for generating converted signals from the input and pump signals of each channel. A plurality of bypass paths 14a, 14b and 14c and a half-wave plate 16 connect, respectively, the output of the DFG waveguides 10a, 10b and 10c to the PBS 13. The converted signals (and input and pump signals) of each channel are passed to the second port 2 and out the third port 3 of one of the optical circulators 12a, 12b and 12c.

Please replace the lengthy paragraph beginning on page 13, line 30 and continuing on to page 14, with the following three paragraphs, the last of which is amended:

Fig. 9 illustrates another integrated approach is shown which utilizes a polarization beam splitter (PBS). As in the previous embodiments of the present invention, the polarization splitter may be comprised of differing waveguide materials that support orthogonal polarization modes. Additionally, a GRIN lens 130 may be configured to reflect and interchange the beams exiting each waveguide at the opposite end of the chip. A quarter-wave plate 132 rotates the reflected light by 90° (via two passes) and the GRIN lens 130 ensures the rotated components enter the appropriate waveguide which supports that polarization. At least one waveguide arm contains a wavelength converter structure. The reflected beams are then recombined at the input of the chip and may exit an input fiber via a circulator, as previously described.

An alternative polarization diversity scheme is shown in Fig 10. A quarter-wave plate is created, preferably in lithium niobate or the same material as the wavelength converter (WC), with its axis oriented 45 degrees to the preferred polarization direction of the WC. The waveguide material is chosen to support both TE and TM polarization modes. For example, metals such as titanium- or zinc-diffused waveguides in lithium niobate, as well as others known in the art, may be used. Since the two materials are identical, they can be butted together without index matching or subsequent losses. Furthermore, the waveguide can be fabricated into the combined substrate (i.e., WC and waveplate) so as to eliminate losses. The exterior surface of the waveplate is coated with a dielectric mirror coating reflecting the pump and signal wavelengths; this coating could also transmit the spectral region into which the converted output will be transmitted, thus eliminating the out-of-band amplified spontaneous emission (ASE) noise from an erbium doped fiber amplifier (EDFA). The waveplate causes a 90 degree rotation of the input signals, so that the polarization component that was optimal for the forward pass is flipped 90 degrees to the non-converting orientation, and vice versa. The pump is frequency-doubled within the waveguide, and the waveplate is fabricated to be quarter-wave in the 1550-nm band and half-wave at the frequency-doubled band (~780 nm). Thus the polarization of the frequency-doubled light is oriented at its original orientation on the roundtrip and can still pump the flipped polarization component of the signal light on the return pass.

Additionally, the pump source may be chosen to be a single-longitudinal-mode source with high phase correlation. The nonlinear gain for the WC is greatly reduced for signals

with randomly varying phases; thus a single longitudinal mode ITU grid signal **[[sill convert]]** <u>still converts</u> with a high nonlinear gain, but random noise**[[,]]** converts with a reduced gain. The advantage of this scheme is that it eliminates the fiber-to-chip coupling losses of other schemes and simplifies packaging into a single compact and monolithic unit. Ideally, if a WC is employed in every EDFA in the network**[[. Then]]**, then the need for optical-electrical–optical (OEO) regenerators may be eliminated or restricted to ultra-long fiber spans. To this end, there is another noise enhancing characteristic utilizing spectral inversion.